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ABSTRACT

This paper investigates the effects of faculty learning style on students' grades in five different class sections at the University of Central Florida. Convenience samples were drawn from the five classes to determine if there was a relationship between teacher learning style and student achievement in their classes, which were: Chemistry I, Chemistry for Non-Majors (two sections), General Biology, and Law and the Legal System. Kolb's Learning Style Inventory was administered to faculty and students in the classes, and one-way analysis of variance and chi-square measurements were conducted to determine significant differences in grade and learning style. Results from two of the five classes indicated that students with a learning style matching that of the instructor tended to have higher grade averages, although not significantly higher, than students with learning styles different from the instructor. However, other factors affected the learning outcomes of the students, such as supplemental instruction, teacher preparation flexibility, and initial student ability. Further research is needed to verify the impact of teacher learning styles on student outcomes. (Contains 14 references.) (Author/SM)

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"Assessing the Impact of College Teachers' Learning Style on Student Outcomes: A Pilot Study at the University of Central Florida"

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Abstract

The paper, "Assessing the Impact of College Teachers' Learning Style on Student Outcomes: A Pilot Study at the University of Central Florida," investigates the effects of faculty's learning style on students grades in five different class sections. Convenience samples were drawn from the five classes to determine if there was a relationship between teacher learning style and student achievement in their classes: Chemistry I, Chemistry for Non-majors (2 sections), General Biology, and Law & the Legal System. Kolb's Learning Style Inventory was administered to faculty and students in the classes and the one-way analysis of variance and the Chi-square statistical measurements were conducted to determine significant differences in grade and learning style. Results from two of the five classes indicated that students with a learning style matching that of the instructor tended to have higher grade averages, although not significantly higher, than students with learning styles different from the instructor. However, other factors affected the learning outcomes of the students such as Supplemental Instruction, teacher presentation flexibility, and initial student ability. Further research is needed to verify the impact of teacher learning styles on student outcomes.

"Assessing the Impact of College Teachers' Learning Style on Student Outcomes: A Pilot Study at the University of Central Florida"

by
Bonnie Z. Warren

Introduction

The purpose of this study was to investigate faculty and student learning styles in selected courses at the University of Central Florida (UCF) to determine their relationship to student learning outcomes. The question was posed, "Do students whose learning style matches that of the instructor achieve higher final course grades than those whose learning styles do not?"

Rationale and Background

Do instructors unconsciously bias their teaching style toward a certain type of learner? This study explored the effects of faculty's learning style on students' grades. Many faculty are not aware that their own learning/teaching style affects students' learning outcomes in their classrooms as well as student retention (Felder & Silverman, 1988; McCaulley et al, 1983; McCaulley, 1976). Ramirez and Castaneda (1974) found that teachers were significantly more field-independent (analytical) in their teaching style than the Mexican American students in their classes who were more field-dependent (global) in their learning style. Stice (1987) states, "Students whose learning style matches the teacher's should have an easier time learning from that teacher than do students with different styles." Hueter (1976) reported that one major characteristic of an exemplary educational climate is a strong connection between students' learning styles and teachers' teaching styles. Berlocher & Hendricson (1985) identified the effectiveness of the match between faculty and student learning styles in dental school and concluded

the article by stating, "What is not known is the impact of learning style on actual performance in dental school. Further examination of the relationship between faculty learning style, student learning style, and performance is necessary (p. 687)." Menges (1981) in his article, "Instructional Methods," concurs that learners with different learning styles will prefer different instructional styles.

McCarthy (1987) found that traditional education is biased toward students and teachers who are Assimilator and Converger learning styles. This was confirmed in the UCF research. The highest percentages of faculty and students were found in the Assimilator and Converger learning style categories. When UCF percentages were compared with national percentages, significant differences at the .05 level were found using the Chi-square statistical measurement on the Diverger, Converger, and Assimilator variables. The Accommodator learning style percentages were similar across the three groups.

Kolb (1996, 1985, 1984, 1981) characterized four types of learners and the learning environments in which they succeed: Assimilators, Accommodators, Divergers, and Convergers. Faculty at the University of Central Florida responded to environments in which they learned the best in the following manner. Accommodators enjoyed discussions, group projects, and hands-on activities, while Assimilators preferred reading, researching, lecture and independent work. Divergers enjoyed breaking the rules, personal involvement, and trial & error approaches, while Convergers preferred following rules and logical arguments, working alone, and solving problems. Based on these responses, it was apparent that different learning styles preferred different types of activities and environments. What inspires and energizes one group of learners, frustrates

and defeats another group. If a professor has a learning/teaching style different from many of the learners in his/her class, does that affect the students' grades in the class? The following data were collected to begin to answer this question.

Data Source

Kolb's Learning Style Inventory (LSI) was administered to a sample of 807 students and 108 faculty at the University of Central Florida, Orlando, a large metropolitan university. The LSI is a self-report instrument revealing valid relationships between learning styles and student's career field of study (Kolb, 1996, p.5&77; 1981; 1984) and was normed on a large sample of 1,446 adults with diverse backgrounds and ethnicity. It is a simple, straightforward instrument composed of rank ordering 12 sets of learning situations. It reveals good internal reliability as measured by Cronbach's Standardized Scale Alpha (.73-.88; n=268). The revised and simplified LSI version of 1985 was compared with the Original LSI version using Spearman-Brown's split-half reliability and indicated strong correlations between the two instruments.

Using Kolb's Learning-Style Inventory, (Kolb, 1985; Ferrell, 1983) students and faculty had to rank order from one to four, (four being how you learn best and one being the least) twelve sets of four learning situations such as: I am an intuitive person; I look at all sides of issues; I like to analyze things; I like to try things out. From these twelve sets, the four cognitive learning styles of Accommodator (leader, risk-taker, achiever), Assimilator (planner, theorist, analyst), Diverger (creator, artist, sensitive to values), and Converger (problem-solver, deducer, decision-maker) evolved. These styles were then related to career majors in college. For example, business majors tended to exhibit the Accommodator learning style, science majors the Assimilator style, engineers the

Converger style, and literature, drama, and art majors tended to exhibit the Diverger style (Kolb, 1996, 1984, 1981).

Method

Samples from faculty, student, and national populations were first compared to gain a general view of the similarities and differences among the various learning style groups. Student responses from a sample population of 807 indicated the following percentages. Assimilators were the highest percentage at 38%, the Convergers were the second highest at 22%, the Accommodator were third highest at 20%, and the Divergers as the lowest at 19%.

The LSI was also administered to 108 faculty at a Summer Institute. The faculty learning style profile and the student learning profile ranked learning styles similarly. The Assimilators were the largest percentage at 39%, the Convergers were also the second highest learning style in the faculty population with 28%, the Accommodators were the third highest percentage at 19%, and the Divergers obtained the lowest percentage at 14%. When the Chi-square statistical assessment was conducted, no significant differences were found between the two groups on the four learning-style measures.

Although the rank order was the same and there were close approximations on the Assimilator and Accommodator styles, substantial disparities existed between the Converger with a six point difference favoring the faculty and a five point difference favoring the students in the Diverger category.

When comparing the UCF faculty and students to the national percentages, significant differences (.00 at the .05 level) were found using the Chi-square statistical

measurement. The national percentage for Assimilators at 27% was 11 & 12 points significantly lower than UCF faculty and students respectively, while the national percentage for the Diverger category at 31% was 17 & 12 points significantly higher than UCF faculty and students. UCF students at 22% were similar to the national percentage of 19% on the Converger category, while the faculty showed a disparity of 9 points at 28%. Accommodator percentages for the national average at 23% were similar to those found within the UCF educational environment at 19% and 20%. The high UCF percentages of Assimilators and Convergers can be attributed to the thinking styles that predominate in the traditional educational setting. According to the research, traditional education is biased toward Assimilators and Convergers (McCarthy, 1987).

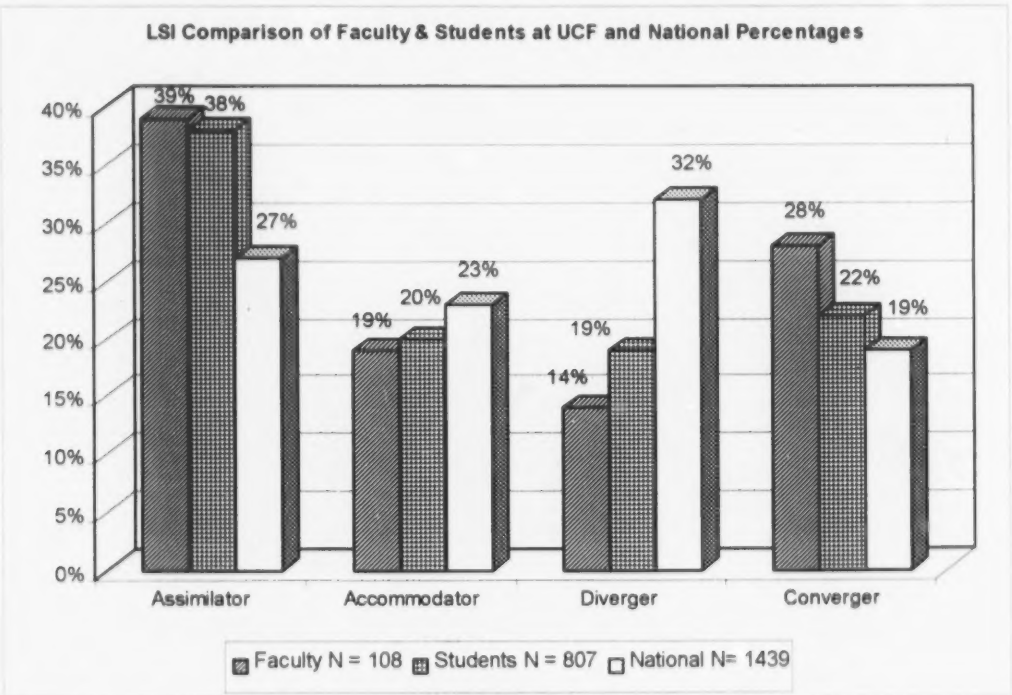

Table 1.

Convenience samples were drawn from 5 class sections and students were asked to complete Kolb's Learning Style Inventory. The grades of these students were

statistically compared among the four learning style categories using a one-way analysis of variance. These averages were then compared to the predominant learning style of the professor of the course. The sample size varied from class to class. The samples from 2 of the classes, General Biology & Chemistry I, were obtained from students attending the Supplemental Instruction (SI) program. This program provides out of class group study sessions and increases the As & Bs and decreases the Ds & Fs in the course; consequently, the averages for these groups were higher than those found in the total class population. Student samples from the other 3 classes cited, Chemistry for Non-majors (2 sections) and Law & the Legal System, were taken from those present on the day when the LSI was administered in their class.

Results

Five classes were sampled to determine if there was a relationship between teacher learning/teaching style and student achievement in their classes: Chemistry I, Chemistry for Non-majors (2 sections), General Biology, Law & the Legal System. Results from two of the five classes indicated that students with a learning style matching that of the instructor tended to have higher grade averages than students with learning styles different from the instructor. However, other factors affected the learning outcomes of the students such as Supplemental Instruction, teacher presentation flexibility, and initial student ability. Further research is needed to verify the impact of teacher learning styles on student outcomes.

Chemistry I

The first course investigated was a Fundamentals of Chemistry I class with an Assimilator professor. Grade averages from a sample of 47 out of 204 students were

statistically compared within their learning style group using a one-way analysis of variance. None of these averages was significantly different from the others; however, students with Assimilator and Diverger styles had the highest averages, both at 2.6 as compared with the Accommodators at 2.3 and the Convergers at 2.2. Because Divergers are in the lowest percentage for faculty styles, this finding was surprising. Upon sharing this information with the professor, he indicated that his avocation was that of a musician; furthermore, he had noticed when he taught General Chemistry for Non-majors that the music majors received the highest grades in his class. Additionally, when the Cycle of Learning for this professor was analyzed, he indicated secondary strengths in the Diverger quadrant. This example gave an insight into the effect of a professors' learning style(s) on his teaching style and on the subsequent achievement of students in his class.

One-way analyses of variance were also conducted on learning styles and SAT scores and high school grade averages to see if there were any initial significant differences among the learning styles. No significant differences were discovered; however, the Convergers had the highest SAT average with 1189, the Assimilators were second with 1135, and Divergers and Accommodators were lowest with 1110 and 1106 respectively. Regarding high school grade averages, the Divergers were highest with a 3.8 average, Convergers and Assimilators were second highest with 3.7 averages, and Accommodators were lowest with a 3.3 high school average. Based on this additional information, the Convergers initially appeared to have an edge on the other students, but they ended up with the lowest GPA of the four learning style groups. It seems likely that the learning style of the professor had an impact on the students' achievement in this course.

Chemistry I
Assimilator/Diverger Professor

Course grade average	2.6 Assimilator	2.6 Diverger	2.3 Accommodator	2.2 Converger
High School grade average	3.8 Diverger	3.7 Assimilator	3.7 Converger	3.3 Accommodator
SAT score	1189 Converger	1135 Assimilator	1110 Accommodator	1106 Diverger
Number of students	15 Assimilator	14 Converger	10 Diverger	6 Accommodator

No significant differences at the .05 level.

Table 2.

Law & the Legal System

The second course sampled was a course on Law and the Legal System with an Assimilator/Diverger professor. Thirty-three out of 48 students responded to the LSI in the middle of the semester. This course did not have the Supplemental Instruction program conducted with it. When the one-way analyses of variance on the grades and learning style comparisons were conducted at the end of the semester, the Assimilators and Divergers whose style matched that of the teacher's learning style performed better than the other students, but not significantly so. The Assimilators obtained the highest grade average of 3.2, the Divergers the second highest with 3.1, the Accommodators the third highest at 2.8, and the Convergers obtained the lowest average at 2.7.

In addition, SAT and high school grade averages were compared to see if there were any initial differences among the learning style groups. No significant differences were found within either measure; however, high school and UCF course grade averages showed similar achievement patterns related to the professor's learning/teaching style. High school grade averages revealed that the Divergers had the highest at 3.3, Assimilators were second highest at 3.2, Convergers were third highest at 3.0, and

Accommodators were lowest at 2.9. In both course grades and high school grades, the Assimilators and Divergers obtained the highest grade averages with Accommodators and Convergers obtaining lower scores.

The SAT scores revealed a different pattern of achievement for the various learning style groups. The SAT scores indicated that the Convergers obtained the highest SAT average at 1030, the Assimilators obtained the second highest at 1010, the Accommodators the third highest at 943, and the Divergers obtained the lowest at 917. Although Convergers were highest on their SAT scores, they had the lowest grade average of the four groups at the end of the term. An inference might be that the Diverger learning style was encouraged and the Converger learning style was discouraged by the Assimilator/Diverger professor.

An additional insight into the Law and the Legal System occurred when we looked at the scores on specific areas of the course such as quiz grades and the midterm test. When one-way analyses of variance were run on these measures, significant differences were not found. However, there were large disparities between the Assimilator and Accommodator categories. Assimilators achieved a much higher average on the quizzes (75) and midterm (76) grades than did the Accommodators (55 & 63). When specific areas within a course are addressed, greater differences in achievement among the learning style categories are more likely to be noted than when the overall grade average for the term is considered.

Law & the Legal System
Assimilator/Diverger

Course grade average	3.2 Assimilator	3.1 Diverger	2.8 Accommodator	2.7 Converger
High School grade average	3.3 Diverger	3.2 Assimilator	3.0 Converger	2.9 Accommodator
SAT score	1030 Converger	1010 Assimilator	943 Accommodator	917 Diverger
Number of students	16 Assimilator	7 Accommodator	6 Diverger	4 Converger

No significant differences at the .05 level

Table 3.

Chemistry for Non-majors (1)

The third and fourth classes researched were two Chemistry for Non-majors courses taught by the same professor with a Converger learning style. The same class was compared during the two terms of fall of 1997 and 1998 to determine if there was a change in student learning styles and performance. In the fall of 1997, 147 out of 235 students completed the LSI toward the end of the term. The LSI sample in this class was conducted with all of the students, not just the Supplemental Instruction students.

One-way analyses of variance were conducted to compare averages among the four styles. No significant differences were discovered; however, Diverger styles were the highest achievers with a 2.8 grade average, the Convergers were ranked second with a 2.7 grade average, Accommodators had the third highest score with a 2.6 grade average, and the Assimilators had the lowest score with a 2.5 grade average. One reason for the achievement of the Divergers in this course was the varied modes of content delivery that the instructor of this course used such as: having the textbook available with a CD ROM to allow for live videos of experiments and real world problems, Supplemental

Instruction, in-class demonstrations and additional video tapes, and lecture notes, homework problems, and exam reviews on the Web.

It is interesting that the Diverger group scored the highest and the Assimilator the lowest of the learning styles. The Assimilators generally are the largest learning style category and the most successful group in the academic environment. A complaint from some of the students was that it was confusing to have so many options available to them. They were used to figuring out the instructor and then adapting to his/her style, not having the instructor adapt to a variety of learning styles. Also, many of the students in the sample benefited from the Supplemental Instruction study sessions.

To gain additional insights, we conducted one-way analyses of variance on the SAT totals and high school grade averages among the learning styles to see if there were initial differences that might affect the learning outcomes. The Convergers had the initial edge and were ranked first with a SAT score of 1082, the Accommodators and Divergers ranked second with a score of 1066, and the Assimilators were ranked last with a score of 1046. In addition, high school grade averages were evaluated with the Converger group again ranking first with a high school grade average of 3.0, the Divergers were ranked second with a score of 2.9, Assimilators and Accommodators were ranked last with grade averages of 2.8. Neither the SAT scores nor the high school grade averages were significantly different from the others. However, it is interesting to note that the Convergers had an academic edge in this class, but did not keep it perhaps due to the varied presentation of the course content.

Chemistry for Non-majors (1)
Converger Professor

Course grade average	2.8 Diverger	2.7 Converger	2.6 Accommodator	2.5 Assimilator
High School grade average	3.0 Converger	2.9 Diverger	2.8 Accommodator	2.8 Assimilator
SAT score	1082 Converger	1066 Diverger	1066 Accommodator	1046 Assimilator
Number of students	60 Assimilator	39 Converger	26 Accommodator	22 Diverger

No significant differences at the .05 level.

Table 4.

Chemistry for Non-majors (2)

For the fall of 1998 Chemistry for Non-majors class, the results were surprisingly different from the 1997 class. The total sample included 224 out of 272 students, a much better representation of students taken at the beginning of the term, not the end as in the last sampling. Once again the instructor used a variety of multimedia enhancements as well as Supplemental Instruction and math lab tutoring to support student learning. The grades at the end of the term indicated the Divergers obtained the highest grade average of 2.4, the Accommodators and Assimilators were equal with the second highest average of 2.2; however, the Convergers, who had been ranked second in the previous class, obtained the lowest overall average of 1.9. The largest difference observed was between the Diverger with a 2.4 and the Converger wth a 1.9 grade average; however, none of the differences were significant. One explanation is that the instructor was aware of learning/teaching style differences in teaching the fall 1998 class and not when teaching the fall 1997 class and may have consciously tried not to favor the students with her own learning style, thus creating this disparity in learning style outcomes.

Again, a one-way analysis of variance was conducted across the learning style groups to see if there were initial differences. No significant differences were found among the SAT learning style group averages; however, Convergers ranked lowest at 1058 while Assimilators ranked highest at 1089, the Divergers ranked second highest at 1078, the Accommodators ranked third highest at 1064. In addition, no significant differences were found among the learning style groups on the measure of high school grade averages with Assimilators obtaining the highest average at 3.5, Accommodators and Convergers second highest at 3.4, and the Divergers the lowest at 3.3.

Having found no initial differences on these two measures, the conclusion might be drawn that the main effect was related to the various teaching modes presented during the semester that enhanced the learning style of the Diverger and confused the Converger learning style.

Chemistry for Non-majors (2)
Converger Professor

Course grade average	2.4 Diverger	2.2 Assimilator	2.2 Accommodator	1.9 Converger
High School grade average	3.5 Assimilator	3.4 Converger	3.4 Accommodator	3.3 Diverger
SAT scores	1089 Assimilator	1078 Diverger	1064 Accommodator	1058 Converger
Number of students	69 Assimilator	49 Accommodator	41 Diverger	34 Converger

No significant differences at the .05 level.

Table 5.

General Biology for Majors

The fifth class reviewed was that of 77 out of 407 students in a General Biology for Majors class with an Assimilator professor. The professor's learning profile indicated that he adhered strongly to his Assimilator type with little variation toward other styles.

His teaching style involved mainly a lecture format with PowerPoint slides that were available to students on the Web, multiple-choice tests, and some organized in-class discussion time. Surprisingly, the Accommodator learning style had the highest average with a 3.0, the Assimilator style matching that of the professor was second highest with a 2.8, both the Diverger and the Converger categories were third with 2.5 averages; however, none of the grade averages was significantly different from the others.

One possible explanation for the higher achievement of the Accommodators over the Assimilators might be the supportive group study sessions provided by the Supplemental Instruction (SI) program. Accommodators thrive on the personal interaction provided by small group discussion available during the Supplemental Instruction sessions.

In addition, one-way analyses of variance were also conducted on learning styles in connection with SAT scores and high school grade averages to see if there were any initial significant differences among the learning styles. On the SAT measure, Accommodators ranked first with a score of 1107, while the Assimilators ranked last with a score of 989, 118 points lower than the Accommodators' score. The Convergers ranked second with a with a score of 1056, and the Divergers ranked third with a score of 1030. Likewise, on the high school grade averages, the Accommodators also ranked the highest with an average of 4.0, the Convergers were second highest with an average of 3.6, Assimilators were third highest with a 3.5 average, and Divergers were lowest obtaining a high school grade average of 3.1. To conclude, the Accommodators ranked the highest on all three variables of class grade, SAT score and high school grade average. Contrary to the normal trend of students doing best whose learning style matched that of the

instructor, the Accommodators had an initial edge with their higher SAT scores and high school grade averages and maintained that edge in this course inspite of the Assimilator teaching style of the professor. The fact that the sample population attended the Supplemental Instruction sessions might have been the determining factor to the Accommodators maintaining their initial successful edge in this course taught by a strong Assimilator professor.

Biology for Majors
Assimilator Professor

Course grade average	3.0 Accommodator	2.8 Assimilator	2.5 Diverger	2.5 Converger
High School grade average	4.0 Accommodator	3.6 Converger	3.5 Assimilator	3.1 Diverger
SAT score	1107 Accommodator	1056 Converger	1036 Diverger	989 Assimilator
Number of students	25 Assimilator	19 Converger	9 Diverger	9 Accommodator

No significant differences at the .05 level.

Table 6.

Conclusions

Based on this limited sample of five college instructors and their classes at the University of Central Florida, the research gathered concerning the question, "Do students whose learning style matches that of the instructor achieve higher final course grades than those who do not?" was inconclusive. Two of the five classes sampled indicated a tendency for students whose learning style matched that of the professor to achieve higher grade averages than students with learning styles different from the instructor. However, other factors such as Supplemental Instruction, teacher presentation flexibility, and initial student ability affected the learning outcomes of the students. A larger sampling and greater variety of faculty and classes needs to occur in order to make

a more conclusive statement regarding the effects of faculty learning styles on student grades.

The course, Law and the Legal System, indicated that when specific areas within a course are addressed, such as quizzes or Mid-terms, greater differences in achievement among the learning style categories are more likely to be noted than when overall grade averages for the term is considered. On the quiz and mid-term grades, the Accommodators performed much lower than the other learning style groups. Small group discussions, role plays, group projects, or class presentations are forms of learning which this professor could use to allow the Accommodators to succeed in this class. If course material is presented in a variety of formats, each of the learning styles has their chance to succeed.

Implications

The evidence from this research clearly demonstrates that faculty have a variety of student learning styles in their classes. A varied approach to meet the diverse needs of the learners would be a logical step in becoming a more effective communicator. Some examples of instructional methods that Divergers would prefer are class discussions, making learning relevant to real world experiences, simulations, role-plays, and brainstorming activities, guidelines for organizing information, and creative assignments. Accommodators would enjoy collaborative learning groups, inductive teaching, relating details to the big picture, hands-on, active learning experiences, and doing presentations. The Assimilator learning style enjoy lectures, reading, researching information, organizing information for themselves, deductive information, and independent learning.

Convergers prefer deductive teaching presentations, convergent thinking exercises, hands-on activities, and independent learning situations.

How can you meet all the needs of the learners present in most classrooms without frustrating all of the learners? Based on the research in these 5 classes, switching from one mode of presentation to another can be confusing to the Convergers. Assimilators and Convergers prefer independent learning while Accommodators and Divergers enjoy group activities. However, teaching to just one style of learner is not the answer as well.

Learning Model

You can begin by creating a **Learning Model** that involves all of the learners. For instance, when you begin a lesson you need to motivate and focus the learners on the information to be learned by using real world examples, personal experiences and tapping into prior knowledge. This stage can be called **Motivating Learning** and addresses the needs of the Divergers in your class. The second step in your lesson could be called **Concept Building** in which you give an overview of the principles to be studied, show relationships among facts, and develop understanding of specific concepts and terms. Within the Concept-building stage, you might use visuals, models, or examples from the text or other readings to develop the learner's knowledge base. Quite often this stage is represented by the lecture mode. This stage addresses the needs of the Assimilators in the class, and for many teachers, is the most developed area of their teaching. The third stage could be that of **Experimenting**, where students then are able to apply the concepts they have learned to the real world. They can test the relevancy and accuracy of the information they have received. Examples of this would be building models, creating a

computer program, completing a project using the concepts, performing an experiment in a lab, or writing a poem, painting a picture, or performing a play. This stage would involve the Converger learning style. The fourth stage could be called **New Insights** where the project, play, painting, or experiment is evaluated and new solutions, new models, new theories are developed based on the outcomes of the applications. This stage is where the Accommodators can excel and feel more comfortable with their learning style. At each of the four stages, one of the learning styles has a chance to succeed and be encouraged. The other learning styles have a chance to grow and develop strengths in other areas as you move through the **Learning Model** (Kolb, 1996; McCarthy, 1987; Stice, 1987).

Learning Model

New Insights • New solutions/models/approaches • Evaluation of experiments • Synthesis of information	**Motivating Learning** • Real world examples • Simulations/role plays • Prior knowledge activated
Experimenting • Test information • Apply concepts & theories to real world • Create tolerance for ambiguity	**Concept Building** • Overview of content principles • Understanding facts & relationships • Developing theories

Limitations

The data is based on a select population at a large Florida university using a convenient sample from five class sections in which the instructors agreed to administer the LSI to their students and themselves. The results cannot be generalized to other populations except in overall trends that that emerged. The use of end term grades to determine student success within the various learning styles is a broad outcome containing a variety of influences. As noted in the course on Law & the Legal System,

when specific areas such as quizzes or midterm grades were targeted, greater variations based on learning style were easier to identify. Additionally, Kolb's Learning Style Inventory focuses on cognitive behavior only and is restricted for analysis purposes by the set of twelve statements provided within the framework of the inventory, and the results assume stability and consistency of behavior.

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